

CLAIMS

1. A coating composition comprising:

(A) 100 weight parts of (i) at least one compound containing at least one acrylate group or (ii) at least one compound containing at least one isocyanate group;

5 (B) 3-300 weight parts of at least one aminofunctional silicone resin comprising the units:

$(R_3SiO_{1/2})_a$ (i)

$(R_2SiO_{2/2})_b$ (ii)

$(RSiO_{3/2})_c$ (iii) and

10 $(SiO_{4/2})_d$ (iv)

wherein R is independently an alkyl group, an aryl group, or an aminofunctional hydrocarbon group, a has a value of less than 0.4, b has a value of zero or greater than zero, c has a value of greater than zero to 0.7, d has a value of less than 0.3, the value of $a + b + c + d = 1$, with the provisos that 3 to 50 mole percent of silicon atoms contain aminofunctional hydrocarbon
15 groups in units (i), (ii) or (iii), the -NH- equivalent weight of the aminofunctional silicone resin is from 100 to 1500, the aminofunctional silicone resin is in the form of a neat liquid, solution, or meltable solid, greater than 20 weight percent of unit (ii) is present in the aminofunctional silicone resin, less than 10 weight percent of unit (ii) are $Me_2SiO_{2/2}$ units in the aminofunctional silicone resin, and greater than 50 weight percent of silicon-bonded R
20 groups are silicon-bonded aryl groups, and at least 30 weight percent of all silicon atoms contain an aryl group;

(C) up to 300 weight parts of at least one organic hardener; and

(D) up to 5 weight parts of at least one cure rate modifier.

2. A coating composition comprising:

(A) 100 weight parts of (i) at least one compound containing at least one acrylate group or (ii) at least one compound containing at least one isocyanate group;

(B) 3-300 weight parts of at least one aminofunctional silicone resin comprising the

5 units:

$(R_3SiO_{1/2})_a$ (i)

$(R_2SiO_{2/2})_b$ (ii)

$(RSiO_{3/2})_c$ (iii) and

$(SiO_{4/2})_d$ (iv)

10 wherein R is independently an alkyl group, an aryl group, or an aminofunctional hydrocarbon group, a has a value of less than 0.4, b has a value of zero or greater than zero, c has a value of greater than zero to 0.7, d has a value of less than 0.3, the value of $a + b + c + d = 1$, with the provisos that 3 to 50 mole percent of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the -NH- equivalent weight of the aminofunctional silicone resin is from 100 to 1000, the aminofunctional silicone resin is in the form of a neat liquid, solution, or meltable solid, greater than 20 weight percent of unit (ii) is present in the aminofunctional silicone resin, less than 10 weight percent of unit (ii) are $Me_2SiO_{2/2}$ units in the aminofunctional silicone resin, and greater than 50 weight percent of silicon-bonded R groups are silicon-bonded aryl groups, and at least 30 weight percent of all silicon atoms contain an aryl group;

(C) up to 300 weight parts of at least one organic hardener; and

(D) up to 5 weight parts of at least one cure rate modifier.

3. A composition according to Claim 1 or 2, wherein component (A) is selected from urethane acrylates, acrylated fluorocarbons, soybean oil acrylates, epoxy acrylates, pentaerythritol triacrylate, glycidyl acrylate, isophorone diisocyanate trimers, isophorone diisocyanate, toluene diisocyanate, polyisocyanates, tetramethylxylylene diisocyanate, phenylene diisocyanate, xylene diisocyanate, 1,5-naphthalene diisocyanate, chlorophenylene 2,4-diisocyanate, bitoluene diisocyanate, dianisidine diisocyanate, toluidine diisocyanate, alkylated benzene diisocyanates, methylene-diphenyl-diisocyanate, 3,3'-dimethyl-4,4'-diphenyl-methane diisocyanate, cyclohexylene diisocyanate, 4,4'-methylenedicyclohexyl diisocyanate, tetramethylxylyl diisocyanates, $\text{OCN}-\text{C}(\text{CH}_3)_2-\text{C}_6\text{H}_4\text{C}(\text{CH}_3)_2-\text{NCO}$, isophorone diisocyanate, 1,4-tetramethylene diisocyanate, 1,5-pentamethylene diisocyanate, 1,6-hexamethylene diisocyanate (HMDI), 1,7-heptamethylene diisocyanate, 2,2,4- and 2,4,4-trimethylhexamethylene diisocyanate, 1,10-decamethylene diisocyanate, or 2-methyl-1,5-pentamethylene diisocyanate.

4. A composition according to any of Claims 1 - 3 wherein R is independently selected from methyl, phenyl, or an aminofunctional hydrocarbon group having the formula $-\text{R}^1\text{NHR}^2$ or $-\text{R}^1\text{NHR}^1\text{NHR}^2$ wherein each R^1 is independently a divalent hydrocarbon radical having at least 2 carbon atoms and R^2 is hydrogen or an alkyl group.

5. A composition according to any of Claims 1-4 wherein Component (B) is selected from

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- 5 (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- 10 (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 15 (iii) $(\text{RSiO}_{3/2})_c$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 20 (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$

or

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- 25 (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$
- (v) $(\text{SiO}_{4/2})_d$

wherein a, b, c, and d are as defined above.

6. A composition according to any of Claims 1-4 wherein Component (B) is selected from

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- 5 (ii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$
- 10 (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 15 (iii) $(\text{RSiO}_{3/2})_c$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$,

aminofunctional silicone resins comprising the units:

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 20 (iii) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$

aminofunctional silicone resin comprising the units

- (i) $((\text{CH}_3)_3\text{SiO}_{1/2})_a$
- (ii) $(\text{CH}_3)_2\text{SiO}_{2/2})_b$
- (iii) $((\text{CH}_3)\text{RSiO}_{2/2})_b$ where $\text{R} = -\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- 25 (iv) $(\text{C}_6\text{H}_5\text{SiO}_{3/2})_c$

aminofunctional silicone resin comprising the units:

- (i) $((\text{CH}_3)_2\text{RSiO}_{1/2})_a$ where $\text{R} = -\text{CH}_2(\text{CH}_3)\text{CHCH}_2\text{NHCH}_3$
- (ii) $(\text{CH}_3)_2\text{SiO}_{2/2})_b$
- (iii) $(\text{C}_6\text{H}_5(\text{CH}_3)\text{SiO}_{2/2})_b$



aminofunctional silicone resins comprising the units:



aminofunctional silicone resins comprising the units:



10 aminofunctional silicone resins comprising the units:



aminofunctional silicone resins comprising the units:



20 wherein a, b, c, and d are as defined above.

7. A composition according to any of Claims 1-6 wherein a has a value of 0.1 to 0.3, b has a value of 0.2 to 0.4, c has a value of 0.2 to 0.5, d has a value of 0, 10 to 30 mole percent of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the –
 25 NH- equivalent weight of the aminofunctional silicone resin is from 150 to 350, 20 to 50 weight percent of unit (ii) is present in the aminofunctional silicone resin, 0 to 5 weight percent of unit (ii) are $\text{Me}_2\text{SiO}_{2/2}$ units in the aminofunctional silicone resin, and from 50 to 75 weight percent of silicon-bonded R groups are silicon-bonded aryl groups.

8. A composition according to any of Claims 1-7 wherein Component (C) is selected from multifunctional primary polyamines, multifunctional secondary polyamines, adducts of multifunctional primary polyamines, adducts of multifunctional secondary polyamines, anhydrides, or polyamides.

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9. A composition according to any of Claims 1-8 wherein Component (C) is selected from diaminodiphenyl-sulfone, 4,4'-methylenedi-aniline, a diaminodiphenylether, benzidine, 4,4'-thiodi-aniline, 4-methoxy-6-m-phenylenediamine, 2,6-diaminopyridine, 2,4-toluenediamine, dianisidine, menthane diamine, or pyridine.

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10. A composition according to any of Claims 1-9 wherein Component (D) is selected from tertiary amines, phosphine compounds, imidazole compounds, diazabicyclo compounds, and their salts.

11. A composition according to any of Claims 1-9 wherein Component (D) is selected from tributyl phosphine, triphenyl phosphine, tris(dimethoxyphenyl)phosphine, tris(hydroxypropyl)phosphine, tris(cyanoethyl)phosphine, tetraphenylphosphonium tetraphenylborate, methyltributylphosphonium tetraphenylborate, methyltricyanoethyl phosphonium tetraphenylborate, 2-methyl imidazole, 2-phenyl imidazole, 2-ethyl-4-methyl imidazole, 2-undecyl imidazole, 1-cyanoethyl-2-methyl imidazole, 1,4-dicyano-6-(2-methylimidazolyl-(1))-ethyl-S-triazine, 2,4-dicyano-6-(2-undecylimidazolyl-(1))-ethyl-S-triazine, 1-cyanoethyl-2-undecylimidazolium trimellitate, 2-methylimidazolium isocyanurate, 2-ethyl-4-methylimidazolium tetraphenylborate, 2-ethyl-1,4-dimethylimidazolium tetraphenylborate, 2,4,6-tris(dimethylaminomethyl)phenol, benzyl dimethylamine, tetramethylbutyl guanidine, N-methyl piperazine, 2-dimethylamino-1-pyrroline, triethylammonium tetraphenylborate, 1,5-diazabicyclo(5,4,0)-7-undecene, 1,5-diazabicyclo(4,3,0)-5-nonene, 1,4-diazabicyclo(2,2,2)-octane, tetraphenylborates, phenol salts, phenol novolak salts, 2-ethylhexanoates of diazabicyclo compounds, resorcinol, dicyandiamide, or boron trifluoride.

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12. A composition according to any of Claims 1-11 wherein Component (D) is selected from propargyl alcohol, ene-yne compounds, dimethyl maleate, triorganophosphines, diorganophosphines, organophosphones, triorganophosphites, organomeraptanes, diorganosulfides, hydrogen sulfide, benzothiazole, benzothiazole disulfite, ammonia, primary alkylamines, secondary alkylamines, tertiary alkylamines, arylamines, urea, hydrazine, triethylamine, tributylamine, N-methylmorpholine, N-ethylmorpholine, 1,4-diaza-bicyclo-(2,2,2)-octane, N-cetyl dimethylamine, N-methyl-N'-dimethylaminoethyl-piperazine, N,N-dimethylbenzylamine, N,N-dimethylcyclohexylamine, 1,2-dimethylimidazole, tin(II) acetate, tin(II) octoate, tin(II) ethylhexoate and tin(II) laurate, dibutyltindiacetate, dibutyltindilaurate, dibutyltinmaleate, dioctyltindiacetate, tin salt-amino pyridine complexes, tin salt-amino pyrimidines complexes, tin salt-hydrazino pyridine complexes, tin salt-tetrahydropyrimidine complexes, cobalt(III) acetylacetonate, cobalt naphthoate, manganese naphthoate, lead oleate, zinc naphthenate, zirconium naphthenate, tetraalkylammonium hydroxide, sodium hydroxide, or sodium methylate.

13. A composition according to any of Claims 1-12, wherein the composition further comprises at least one ingredient selected from plasticizers, pigments, colorants, dyes, surfactants, thickeners, heat stabilizers, leveling agents, anti-cratering agents, fillers, sedimentation inhibitors, ultraviolet-light absorbers, promoters, antioxidants, ultraviolet-light inhibitors, or fillers.

14. A composition according to any of Claims 1-13, wherein the composition further comprises filler selected from hollow microspheres, fumed silica, precipitated silica, silicic anhydride, hydrous silicic acid, carbon black, ground quartz, calcium carbonate, magnesium carbonate, diatomaceous earth, wollastonite, calcined clay, clay, talc, kaolin, titanium oxide, bentonite, ferric oxide, zinc oxide, glass balloon, glass beads, mica, glass powder, glass balloons, coal dust, acrylic resin powder, phenolic resin powder, ceramic powder, zeolite, slate powder, organic fibers, or inorganic fibers.

15. A composition according to any of Claims 1-14, wherein the -NH- (amine H) equivalent weight to acrylate or isocyanate equivalent weight ratio is typically from 0.8:1-1.2:1.

- 5 16. A coating composition obtained by a method comprising reacting:
- (A) 100 weight parts of (i) at least one compound containing at least one acrylate group or (ii) at least one compound containing at least one isocyanate group;
- (B) 3-300 weight parts of at least one aminofunctional silicone resin comprising the units:
- 10 $(\text{R}_3\text{SiO}_{1/2})_a$ (i)
 $(\text{R}_2\text{SiO}_{2/2})_b$ (ii)
 $(\text{RSiO}_{3/2})_c$ (iii) and
 $(\text{SiO}_{4/2})_d$ (iv)
- wherein R is independently an alkyl group, an aryl group, or an aminofunctional hydrocarbon
- 15 group, a has a value of less than 0.4, b has a value of greater than 0.15, c has a value of greater than zero to 0.7, d has a value of less than 0.2, the value of $a + b + c + d = 1$, with the provisos that 3 to 50 mole percent of silicon atoms contain aminofunctional hydrocarbon groups in units (i), (ii) or (iii), the -NH- equivalent weight of the aminofunctional silicone resin is from 100 to 1500, the aminofunctional silicone resin is in the form of a neat liquid,
- 20 solution, or meltable solid, greater than 20 weight percent of unit (ii) is present in the aminofunctional silicone resin, less than 10 weight percent of unit (ii) are $\text{Me}_2\text{SiO}_{2/2}$ units in the aminofunctional silicone resin, and greater than 50 weight percent of silicon-bonded R groups are silicon-bonded aryl groups;
- (C) up to 300 weight parts of at least one organic hardener; and
- 25 (D) up to 5 weight parts of at least one cure rate modifier.